# FACTS

FOR ENVIRONMENTAL STUDIES



Ontario Ministry of the Environment

# SET 5E

WOODLAND ACTIVITY BOOK

THE TERRARIUM

SOLID WASTE

TECHNIQUES OF THE BLIND WALK

ORGANIZING THE MIDDLE JUNIOR HIGH LABORATORY



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FACTS FOR ENVIRONMENTAL STUDIES

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# WOODLAND ACTIVITY BOOK

IT'S FALL. The woods abound with ripe seeds. The leaves are at the height of their colors. Small animals are hidden away in the security of a dead log, or under the small stones. A class of small children arrives. A naturalist or teacher leads the procession, busily pointing out the smooth leaves, the rough stones, and the sharp prickers on the bush. The leader encourages the children to listen quietly to the sounds or smell the fragrance from the twigs of the spice bush. How are the children responding to this introduction to the "wonders of the woods"? Many are deeply involved and are fascinated by the touching, smelling, and looking sensations of the outdoor world. Several have made rather interesting discoveries on their own and are busy exclaiming, "Look what I found". There are many, however, who are not involved in this experience. They may be a distance from the leader and are unable to hear. They may feel this freedom gives them the opportunity to chat or play with friends. Is there a different approach that might involve all the children and give them the responsibility for making these discoveries? What other way is there to encourage children to think and make generalizations about their experiences from a "walk in the woods"?

The following guide was prepared to give the children suggestions without predetermining their experience.

## Woodland Activity Book

The basic goal is to encourage children to greater observations and insights. Not a complete study course, it is viewed as an introduction to a new area or a season. It is most successful with second to fourth graders, but it could be altered as a method for older or younger children.

One of the concepts stressed is that there is nothing in this world that doesn't change.

### First-and Second-Grade Level

*The Indians and colonists used the natural materials in the woods to get their colors for dyes. Find as many things in the woods that you think might give a color and try them on pieces of paper.*

The edge of the woods is filled in the fall with goldenrod, and many other wild plants. After a brief demonstration of colors that these plants produce, the children go off to find as many different colors as they can. Bark sometimes gives a rich brown; some berries are orange, blue, or red. Some flowers give interesting results, and there are the surprises when a blueberry gives a green color.

*Make a rubbing of the largest leaf you can find.*

Rubbings are a very good way to record in the woods. This activity gives experience in the concepts of size -- largest, smallest, etc. The directions could call for three leaves ranked on the page according to size. An exercise in ordering.

*Make a rubbing of as many different shaped leaves as you can find.*

If this is too complicated, the children might make rubbings of three different shaped leaves. This activity helps the child to decide what "different shape" means. A big maple leaf and a small maple leaf may be different in size, but they are not different in shape.

*There are many little animals in the woods. Most are hiding. Some come out to hunt at night. Some live under rocks or in dead logs. See if you can find one and draw a picture of it.*

Most every child that has ventured into the woods is fascinated by small creatures. The children undoubtedly discover these animals anyway, but the additional request that they draw what they see requires them to observe more closely the animals' physical characteristics and movements. The millipede is curled up, but unfolds and meanders away when held for its "portrait". The pill bug also curls up, but it moves differently and has a hard shell.

*In the fall most plants produce seeds. Inside you will find a baby plant. Find as many different kinds of seeds as you can and paste them in your notebook.*

One can request that these seeds be grouped in the way they are dispersed, or according to their color, texture, or size.

*Things in the woods feel different. Some feel smooth and some feel rough. Find something that is smooth and something that is rough and make rubbings of them.*

This could be altered -- for example, it could be a page that requests opposites. Something soft and something_____(dry, hard, rough). These objects could also be pasted on the paper, not rubbed.

*Find something that changes and paste it in your notebook. Can you find something that never changes?*

This questions appears easy. The children are generally puzzled until the idea dawns that there is nothing in this universe that doesn't change. A very valuable learning experience.

Third-Grade Level

*In the fall most plants produce seeds. Find as many different kinds of seeds as you can and show they travel.*

On the second-grade level the child was asked to find seeds and paste them in his notebook. At this stage one can request a further step and ask how they travel or even what adaptations the seed has made that increase its survival chances.

*All living things in this world depend on other things in order to live. Make a rubbing of a big leaf. This leaf needs_____in order to grow. What living things need this leaf in order to grow?*

This questions requires some writing and is a departure from the more direct activity-oriented pages.

*There are many animals in these woods. Most are hiding. Some come out to hunt at night. Some live under rocks or in dead logs. See if you can find one and draw a picture of it from below. Show how it looks from the top and from the sides. See if you can find the name of the animal in a book and write its name under your drawing.*

The beginning of this question is the same as for second-grade level, but the latter part extends the work to higher age levels.

*The woods sometimes seem all green, but there are many other colors you can find. Collect a number of colorful things and paste them in your notebook. What color did you find the most? Was there a color that you didn't find at all?*

This activity is especially interesting in the fall with the many bright leaves or in early spring with the multitude of wild flowers.

Fourth and Fifth Grades

*When the dinosaurs lived here this land was different. It was much warmer and most of the present area was covered by swamps. Some of the same kinds of plants that we have now grew here at that time. Find a plant variety that you think grew long ago and make a rubbing of it. Or find a plant type that wasn't around when the dinosaurs were here.*

The questions are more involved and attempt to utilize the knowledge and experience that it is assumed the child has acquired at this stage.

Always carry a bag equipped with crayons, paste, magnifiers, thermometers, reference books, rubbing paper, string, tape measures, etc.

In attempting to evaluate this approach to woodland guided walks, one of the primary achievements is that of total involvement. Although different children vary quite naturally in their degrees of success, they all must pick up a leaf, or find an animal. They must touch, smell, and look. They must also think of what might be the proper response to a question, and generally, there is more than one answer. The teacher becomes the person to help and encourage. It is not the teacher's role to be always "finding" discoveries. This encourages children to depart from the narrow trail following on the heels of the child in front of him.

This has also been a vehicle to encourage parent volunteers to help guide school groups in the woods. These individuals might not feel confident as naturalists with all the expertise that the title suggests, but with a guide book and these activities they feel at ease working with the school groups.

Woodland activities are not designed to replace the continuous return to a spot with all the scientific materials for detailed study. The objective is primarily to have an introduction, a vehicle to open the senses of the children and gain their participation in an active exploration of the woods.

*Adapted from an article by Alice Ballin, New Canaan Country School, Connecticut as published in the book "Environmental Education in the Elementary School...A Selection of Articles Reprinted from Science and Children". This book is available from the National Science Teachers Association, 1742 Connecticut Avenue, N.W., Washington, D.C. 20009. Price $4.75.*

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# THE TERRARIUM

Terrariums have brought joy to people for about one hundred years, ever since Dr. Ward, of England, noted that plants kept growing under tightly sealed glass.

It is easy to teach the interdependence of plants and animals when there is a terrarium in the classroom. Children come to realize, by observing this closed environment, that things constantly change.

Constructing and observing a terrarium will stimulate their interest in investigating the world of living things.

## THE TERRARIUM

### Unit Objectives:

The students will be able to:

1. construct a simple terrarium.
2. describe patterns and shapes.
3. describe changes that are taking place in the terrarium.
4. express their ideas of how the plants and animals in their terrarium need each other.

### Environmental Experience 1: Building the Terrarium

1. Obtain a suitable container for a terrarium: aquarium, mayonnaise jars, clear glass jugs, or any other *transparent* container. List with the children the various components of a terrarium and discuss where these materials might be found on the school grounds.

2. Take a short trip out-of-doors with the class to gather the materials needed. Bring various digging tools and containers.

3. Return to the classroom and deposit the collected materials on a table. Discuss the various components of the terrarium and let the children examine the materials with a magnifying glass if possible.

4. Put some gravel into a container and soil into another and pour a little water into each. Discuss how the soil soaks up water and how the rocks do not. Discuss what might happen if too much water is put into the soil of the terrarium.

5. Discuss the plants you have collected, pointing out roots, young shoots, leaves, and other parts. Ask the children to talk about plants and how they are used.

6. If you have collected a rock, discuss why the rock will be put into the terrarium. What might hide under the rock, sit on the rock, grow on the rock?

7. If you have animals, talk about how they are alike and different. What do they eat? What might happen to them in the terrarium?

8. Discuss with the children the "mini" world of the terrarium; how the plant and animal inhabitants after their death decay and enrich the soil with organic matter.

*Additional Activities*

- Ditto directions and illustrations to be taken home, and urge the children to teach their parents and/or friends how to build a terrarium.
- Have the children enter or display their terrariums in a local flower show, or garden club contest, or conduct your own contest including ribbons for prizes. (No losers, please.)
- Evaluate the health and function of the classroom terrarium. Could there possibly be an imbalance to cause the terrarium to function improperly? What could be done to the terrarium in order to perfect the balance so requisite for its continuous operation?
- If the mini-world is not surviving, have the children check the following conditions:
  balance between living organisms and non-living materials
  type and age of plants and/or animals
  health of plants and/or animals
  balance between plants and animals
  cover or seal
  location in the classroom
- Have them make changes to improve their terrarium.
- Make a jig-saw puzzle.
  Print the names and/or draw pictures of all the materials needed to make a terrarium on a sheet of oak tag board.

Environmental Experience 2: Patterns in the Terrarium

Every plant, animal, or rock has a definite identifying pattern. Toads have a warty, long-legged, popeyed pattern. Sandstone has a sandy pattern. A pattern may develop in the feeding habits of the animals. Patterns of the terrarium are especially well suited to the development of art lessons. Many famous works of art are inspired by the natural world.

Have the children pretend they are bugs or worms living in the terrarium and draw a bug's-eye view of that world.

The children may look for and enjoy acting out some of the several kinds of patterns they see in the terrarium.

Sample patterns in the terrarium:

Spatial Pattern: snail shapes, plant colors, identifying marks of animals, textures of plants and animals, geometric designs. Organizational Patterns: how plants and animals live together. (Community)

Functional Patterns: when the animals eat, when the rain falls, sequence of flower to seed, reproductive cycles.

*Additional Activities*

- Integrate patterns into the art lessons. Look for patterns on the school site and in the classroom. Have the children draw patterns of what they see, feel, and/or learn.
- Conduct a shape treasure hunt; look for circles, stars, cylinders, spirals, cubes, and cones. Use pictures, a nature display table, the terrarium, and the school site as resources. In your classroom you may want to have a nature table. This would be a special area to display things such as leaves, nuts, cocoons, pine cones, and rocks that you or your students collect.
- Develop vocabulary by looking for comparative textures and use adjectives as descriptors. Have the children cut out pictures which depict their vocabulary.

| | | | |
|---|---|---|---|
| rough | soft | metallic | sharp |
| smooth | gritty | furry | slimy |
| sticky | oily | scaly | spiny |
| slippery | powdery | greasy | damp |

Environmental Experience 3: Changes in the Terrarium

Over a period of time, many changes occur in the terrarium. Each day the terrarium's physical environment changes; in addition, all of the living things in the terrarium undergo change. Death and decay are the ultimate form of change in the terrarium. The dead and decomposing animal and plant remains give support for renewed life. The terrarium is a miniature, near-perfect model of the real natural world, and changes in the terrarium can be compared with changes in the natural world.

The children should look for changes and record them. Various tools and instruments may be employed to help observe the changes.

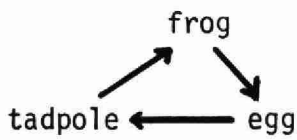
*Terrarium Sample Changes*

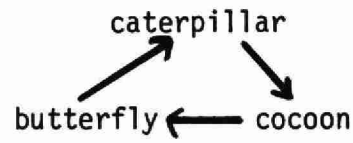
Plants: Seeds sprouting, seedlings growing, flowers developing, fruits, plants decaying, mold forming.
Animals: Reproducing, dying, moving, shedding skin.
Other: Decaying, evapo-transpiration (the rain), temperature, changes in the rocks.

A thermometer and a magnifying glass can help you observe some of the changes of color, plant growth, and others.

*Additional Activities*

- A good extension would be to look for parallel changes on the school site, the aquarium, and pictures that represent change.
- Have the children pretend they are one of the animals living in the classroom terrarium. Write or illustrate an imaginative story about what is changing and happening within this "classroom terrarium" world. Include how the various plants and rocks appear when "eyeball to eyeball" with them.
- Make insect cycle murals using pictures of animals. Example:



- Take an exploration walk near the school or a field trip to a wooded area to give the children an opportunity to note patterns and changes and relate them to their classroom terrarium (their mini-world).

Environmental Experience 4: Interdependence in the Terrarium

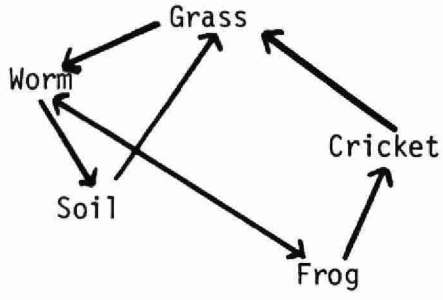
All of the plants and animals of the terrarium are dependent upon the sun for their source of energy. The plants trap the energy of the sun and convert it into food which the animals eat. The plants are the producers, the animals that eat the plants are consumers.

Animals that eat plant-eating animals are the secondary consumers. When a plant or animal dies, the decomposers recycle the dead organism. Both the producers (plants) and the consumers (animals) need water. The water in the terrarium is in a constant cycle. The soil moisture is taken up by the plants and some of it is transpired (evaporated from the leaf) as a vapor into the atmosphere of the terrarium. When the moist air comes into contact with a cool surface, the vapor condenses and falls as "rain" in the terrarium. This usually happens when the room the terrarium is in cooler than the terrarium itself.

Have the children observe the terrarium for interdependence of the organisms and the environment. Ask the children to develop their ideas of how the plants and animals need each other. What things do plants need to grow so that they may feed the animals?

Have the children draw pictures and/or write name tags for the contents of the terrarium (air, sunlight, water, soil, plants, animals). Put their pictures on the blackboard and have the children draw arrows connecting the various interrelated living and nonliving contents of the terrarium.

Example:




This is an example of the complex web of life that occurs in the terrarium. The web never begins or ends; it is cyclic. The grass is eaten by the cricket, who then is eaten by the frog. The frog or cricket dies and is recycled by soil organisms such as worms. Worms also recycle the dead grass, which in turn makes soil so that more grass can grow. Have the children draw a *food chain* from the inhabitants of the terrarium. Draw a chain on the blackboard and have them place name tags or pictures of the organisms inside the links.

*Additional Activities*

- Develop food chains and food webs for the aquarium and the school site. Extend the food chain idea into the school lunch program. Dramatize how the chain is related to the meals the children eat.
- Incorporate songs and games into your lesson.

# APPENDIX

## TEACHER BACKGROUND INFORMATION

You and your class can make a terrarium in anything from a baby food jar to an aquarium (even a leaky one). The principles are the same. The materials you need are:

1. A container that light rays can penetrate
2. Gravel or sand
3. Charcoal
4. Soil with some humus (decayed plant material)
5. Small plants and tree seedlings (dig up soil with the roots). Moss, fern, violets are fine. Keep in a plastic bag until ready for use.
6. Small saucer of water
7. A pretty rock or two
8. Plastic wrap or glass to cover the terrarium
9. A few grass seeds
10. A small thermometer to keep in a corner of the terrarium
11. Animals: a snail or slug, bugs, beetles, frog, toad, ant, grasshopper, snake or caterpillars

Putting it together:

1. First, put in a one- to two-inch layer of gravel for the excess water to drain down into.

2. Then add small pieces of charcoal to the soil. Charcoal is burned wood with lots of air spaces and its addition will keep the soil well aerated and will absorb gases. To use commercial charcoal briquets effectively, break them into small pieces to increase aeration. Better yet, if the briquets are burned, the alkalinity or "sweetness" of the soil increases. For greater effectiveness, add burned wood ashes. This will improve both the physical and chemical structure of the soil.

   (An alkaline or "sweet" soil contains more elements of calcium, potassium, and some compounds such as lime. Some plants thrive better in "sweet" rather than in "sour" soil.)

3. Add two to three inches of topsoil. Don't use playground clay, but soil from under bushes, along fences, or in other areas where some humus has accumulated.

4. Add a small water dish to serve as a pond for animals to drink from and to supply a good humid environment.

5. Add the plants. Space the plants to allow room for growth. You may also want the children to plant a *few* seeds or nuts.

6. Add the animals. Do not put large animals in -- no mammals. A snake or toad needs room; snails, worms, and ants need less room.

7. Place the terrarium near a window but do not let the sun shine directly on the terrarium or you will have an oven instead of a terrarium. Do not set the terrarium on a radiator or other heat sources.

MAINTENANCE:

If the terrarium seems dry and a "rain" doesn't fall from the top of the container, sprinkle a little more water in. If mold is forming, it is too wet. Leave the top off for a day, or leave a slight space in the top covering. Dead plants or animals should be left to illustrate the recycling of material.

The children may respond to a request with more animals than the terrarium can handle. Keep the number and size of the animals limited. Too many slugs can defoliate your terrarium and a medium-sized turtle can trample it. You may have to be selective.

The terrarium can self-support a limited supply of plant-eating animals, and probably only one meat-eating animal. For instance, several grasshoppers will eat the plants and, in turn, be the food for a single toad.

The purpose of limiting the supply of animals to a closed terrarium is to demonstrate how soil, plants, and animals, *thriving within the confines* of the container, depend upon the life and death of each other. The terrarium plants and animals may exist totally independent of any outside forces. This is representative of a closed system. The mini-world in your terrarium is self-supporting.

If you have more animals than the terrarium can hold, you will have to supplement their food. Soft fruit and leafy material for those that eat plants and live worms and insects for the meat eaters will be necessary. A reminder: To use supplemented foods in the terrarium alters the relationships among the soil, plants, and animals. This kind of terrarium would demonstrate a less "closed" system.

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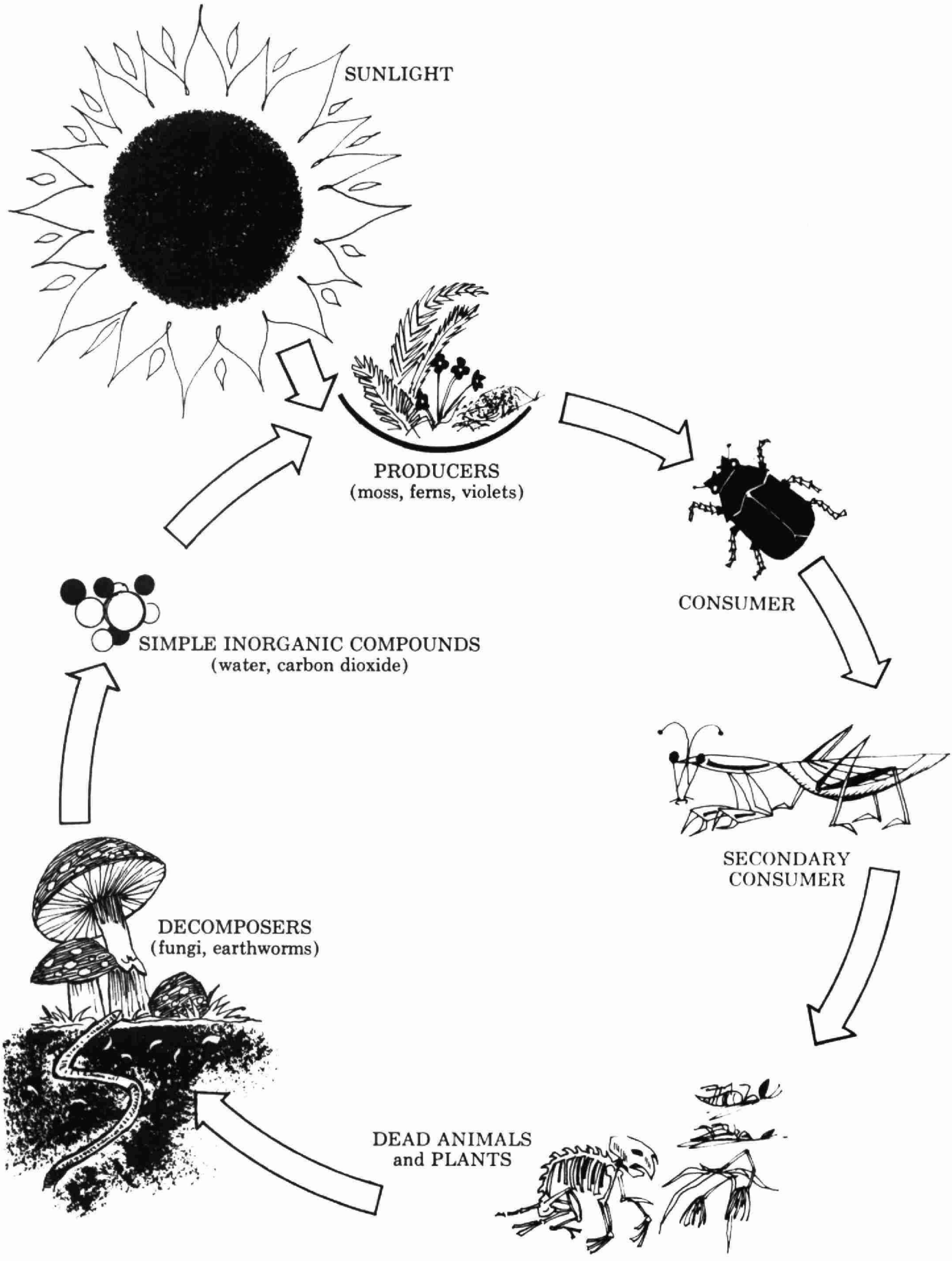
SUNLIGHT
PRODUCERS
(moss, ferns, violets)
CONSUMER
SECONDARY
CONSUMER
DEAD ANIMALS
and PLANTS
DECOMPOSERS
(fungi, earthworms)
SIMPLE INORGANIC COMPOUNDS
(water, carbon dioxide)

FACTS FOR ENVIRONMENTAL STUDIES

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# SOLID WASTE

## Lesson 1: Wastes As A Community And Personal Problem.

Aim:

To identify the problem.

Approach:

Human activities result in the generation of large quantities of many varieties of wastes, presenting problems in their storage, handling, and disposal.

A. What does the term wastes, as they concern man, mean?
   Dictionary Definition: damaged, defective, superfluous, rejected materials; scrap, garbage, rubbish, excrement; fluids allowed to escape without being utilized; sewage, refuse from places of human and animal habitation.
B. Elicit specific examples of common wastes:
   Garbage, rubbish, refuse, paper, glass, rubber, plastic, tin cans, barnyard manure, construction and demolition debris, timber, rocks, concrete, metal, auto bodies, tires, trees and brush, paint, solvents, sewage, industrial wastes.
C. Why worry about wastes at all?
   1. They take up useful space and destroy land values.
   2. They are unaesthetic, unsightly.
   3. They can cause accidents (cuts, bruises) and support costly fires.
   4. They may be unhealthful. Garbage supports fly and rat populations, bearers of disease.
   5. They generate foul and offensive odours, sometimes poisonous gases.
D. Who is responsible for providing the solution to these problems?
   1. Individuals who produce the wastes and to whom they belong.
   2. The community in which he lives.
   3. The agencies to whom he has given the responsibility for carrying out the waste disposal function.

Activity:

A walk through the neighborhood to observe the area -- garbage cans, plastic containers, boxes used for disposal, etc., then write about what they saw, may also take pictures.

## Lesson 2: Wastes As A Community And Personal Problem.

Aim:

To expand Lesson 1.

Approach:

Although we have identified wastes by name, in order to go about the business of solving our waste problem, we need to know more about its nature and origin.

A. Can we classify wastes in another useful way? by origin?
   1. Industrial - chemicals, scrap metals, solvents, cartons, etc.
   2. Commercial - paper, wrappings, cartons, cases, crates, boxes.
   3. Agricultural - cuttings, trimmings, culls, trees, manure.
   4. Domestic and Municipal - source of the above and all the rest as in Lesson 1.

As individuals we are most concerned with domestic and municipal wastes.

A. How many domestic wastes can be classified?
   Paper - 59%; wood, lawn and garden waste - 10%; glass, ceramics, ash - 8½%; metal - 7½%; clothes, rags, plastic, rubber, leather, dirt - 6%.
B. How much material are we talking about?
   1. The average individual produces about 1800 lbs. per year of combined wastes.
   2. How much is this in tons for your City?
   3. If one ton takes up _____ cubic yards, how many cubic yards is that for Phoenix? How many classrooms full?

Activity:

Visit a landfill. See fact sheet "A Visit To A Landfill Site" - Set II.

Lesson 3: What To Do With Solid Wastes.

Aim:

To impart some perspective regarding the collection, storage, and disposal of these wastes.

Approach:

Now that we have gained some knowledge regarding the identity and nature of wastes, it would be useful to determine the best way to handle them.

A. What do you do with solid wastes now?
   1. Set it out for pick-up.
      Advantages and disadvantages:
      The best - but you may not have pick-up service
      - containers are needed
      - must be set out in the right place for pick-up
   2. Dump it on the desert, in the alley, on a vacant lot.
      Illegal, draws flies, rodents, destroys land, fouls up your neighborhood.
   3. Burn it - illegal unless you have an approved incinerator
      - creates air pollution
      - leaves residues which still must be disposed of
   4. Bury it - how about large, bulky objects?
      Where? for how long can you do this? illegal in some places.
   5. Down the garbage grinder
      - illegal in some places because of inadequate sewage and disposal systems
      - doesn't handle everything, in fact only a small part
   6. Feed it to animals - what are the advantages and disadvantages? Elicit responses.
   7. Take it to the city landfill.

Activity:

Draw pictures to show advantages and disadvantages of various means of disposal.

Lesson 4: Solid Waste Disposal Systems

Aim:

To expose the class to the techniques which are accepted or being experimented upon in the disposal of wastes.

Approach:

Certain methods are now being employed to dispose of our solid wastes. Some aspects of these methods are experimental, but all are being used somewhere in our nation and the world. What are they and what are their characteristics?

A. The sanitary landfill - a sanitary landfill is a piece of land to which wastes are taken, deposited, and covered in a healthful, nuisance-free manner.
   1. Location
      a. Enough land to last for years (10 or more if possible).
      b. Located so as not to annoy neighbors.
      c. Located near enough to the sources of wastes so that cost of hauling is not excessive.
      d. Preferable that it be excavated or depressed at outset. A depression makes a good start, but this can be attained by other means.
      e. The soil must be workable so that plenty of clean soil cover is available.
      f. Not located where the operation will result in water pollution.
      g. An ample supply of water is necessary to hold down dust and to extinguish accidental fires.
   2. Equipment
      a. Heavy earth moving equipment for excavation, moving soil, covering finished areas, compressing the wastes into least feasible volume.
      b. Trucks, water supply system, communications, shelter, fences, directional and instructional signs, fire fighting equipment.
   3. Personnel
      Manager, equipment operators.
   4. Good all-weather access roads.
   5. Operation
      a. Refuse is brought to landfill site and dumped in the most confined or limited areas.
      b. Heavy equipment moves the refuse into place and by running over it repeatedly, crushes, and reduces its volume.
      c. At the end of each day six inches of clean soil is placed over the working surface of the refuse.
      d. When the cavity has been filled it is covered with an additional soil cover of at least 30 inches leaving the site finally in a level or finished condition.
   6. Follow-up
      Periodically the landfill is inspected and breaks, openings in the cover, or where the finished surface may have collapsed, are repaired.
   7. Ultimate use
      Parks, playgrounds, golf courses, building construction for light weight buildings, some agriculture (e.g., cotton is raised on finished landfills).

Activity:

Visit to landfill, take pictures. Draw pictures showing what can be done with finished landfill.

Lesson 5: Solid Waste Disposal Systems.

Aim:

Continuation of Lesson 4.

Approach:

An incinerator is a piece of mechanical equipment into which solid waste are placed and ignited so that all combustible parts of the wastes are burned up.

B. Incineration

1. Location

Since incinerators are like industrial operations and may emit smoke, flame, particulates, gases, odours, in addition to storing waste awaiting processing, they should be located where they will not offend the public.

2 Equipment

Waste storage bins

Incinerators - usually a multi-chambered furnace in which material may be dried somewhat, ignited, burned in increasingly hot fires

Ash Storage

Smoke-stack

Trucks for ash removal

Refuse moving equipment, sometimes automatic conveyor belts

Communications, shelter

Water supply for cooling, fire fighting

3. Personnel

Managers and operators

4. Operation

Miscellaneous refuse is dumped on a receiving platform from which it is pushed or conveyed into the first chamber. Here it is ignited and burning begins. The burning material is moved progressively to hotter and hotter parts of the furnace until all combustibles are consumed. The residue may be permitted to cool or is quenched with water, loaded on vehicles and removed.

Advantages:

The volume of material which must be finally disposed of is much reduced, sometimes to 1/5 the original.

The heat which is generated can be used to make power for many uses.

Certain parts of the ash can be reused. Saves land.

Disadvantages:

Useless for handling materials which will not burn. Often a source of serious air pollution.

The residue (ash, etc.) must be disposed of somewhere. Thus, additional equipment, handling, land, and personnel are needed.

Should the incinerator break down an alternate disposal site such as landfill is needed.

Vehicles hauling burned out ash, etc., from the incinerator frequently create a nuisance themselves as they pass through the community.

Lesson 6: Solid Waste Disposal System.

Aim:

Continuation of Lessons 4 and 5.

Approach:

Recycling and composting in their broadest sense, involves the application of a number of techniques to waste disposal with the aim of recovering physical resources which have been discarded in the wastes. There are a variety of techniques used.

C. Composting or recycling

1. Equipment

Receiving stations
Sorting stations
Crushers, grinders, magnets, separators, storage areas for raw material and finished products
Refuse moving trucks, bulldozers, conveyors
Water system for dust and fire control
Shelter, communications
Power

2. Personnel

Manager, operating personnel.

3. Operation

Municipal wastes are deposited in the receiving area where it is converted into a steady stream of limited dimension. The stream moves through a sorting area where glass, paper, rags, plastics, various metals are selectively removed from the stream and sent to selective storage. The residue from this phase of the process is ground up and moved to special chambers where it remains for a specific time under controlled temperature and moist conditions. Here bacterial and fungal action reduces the material to a stable, pasteurized condition.

Further grinding and storage completes the stabilization and the material may be used as a soil conditioner, pressed into briquets or subjected to other processing into useful material.

Advantages:

1. A substantial fraction of what we call wastes are returned to highly diversified availability and use.
2. Wastes become resources.
3. Resource recovery can pay for part or all of the waste disposal.

Disadvantages:

Costly

Can create environmental nuisance - fires, dust, noise, un-aesthetic.

There must be a ready nearby market for the recovered resources to help make the process pay.

Not all materials in wastes lend themselves to composting (plastics, bricks, rugs) and they must be disposed of somewhere else.

If the plant should break down, an alternative method of disposal must be available, since solid wastes production by man is continuous.

Lesson 7: Recycling

Aim:

(Continuation)

Approach:

It has been said many times that because the American people are endowed with huge material resources, they tend to be careless of their consumptions and disposal. In recent years we have become more and more aware of this and are attempting to reverse this attitude.

To expand the concept of resource recovery from solid wastes.

D. Recycling

1. It is now popular to speak of recycling of resources. What is commonly meant?

The extraction of materials from solid wastes and their conversion from waste to usefulness.

What can be recycled?

glass - returned to mills to make new glass
- ground-up and used in road surfacing
- bottles cleaned and re-used as bottles
- 35% of incinerated ash is glass

paper - returned to paper mills and converted to fresh paper
- 20% is recycled now

iron and steel - 20% is recycled in steel foundaries and used as a basis in the manufacture of new metal ignots, shapes, and forms

copper and aluminum, etc. - returned to smelters, purified and reused
- 20% of aluminum comes from scrap

food waste, lawn and garden refuse - composted into soil conditioners and enrichers

rags - used in paper manufacture and as a source of fiber

rubber - can be burned for power, used to resole shoes (auto tires)

timber and logs - recut to useful sizes, converted into charcoal, burned directly for power

bulk wastes - deposited on ocean floor making ideal harborages for the congregation of fish, spawning areas

brick - used brick is as valuable as new brick in certain kinds of construction - particularly residential

Activity:

Collections of various items and taken to recycling centres.

*These lesson plans are reprinted with the permission of Project Outreach funded through the Phoenix Union High School System, Phoenix, Arizona.*

FACTS
FOR ENVIRONMENTAL STUDIES

Ontario Ministry of the Environment

# TECHNIQUES OF THE BLIND WALK

The application of sensory awareness techniques in school environmental programs has brought home to teachers Tilden's (1967) first principle of interpretation:

> "Any interpretation that does not somehow relate what is being displayed or described to something within the personality or experience of the visitor will be sterile."

All humans perceive their world through: 1) a set of physical senses through which we receive the experience of life, and 2) a personality through which we judge or react emotionally to this experience. Although each of us hears, sees, smells, tastes, and touches, a common "reality" can be quite different for individuals of a group. Showing or telling others how we perceive the world can be a rewarding and personal type of sharing. Heron (1976) expressed some of the psychology of awareness as it relates to outdoor education and recreational programs:

> "This phenomenon (sensory awareness) is a major cause of attitude change, behavior modification and learning, growth and development, and value orientation. It is for such reasons that awareness forms a deliberate part of programs such as overt "brainwashing", the Outward Bound movement, outdoor acclimatization (after Van Matre) and certainly the "feelies" of Huxley's Brave New World."

Advertisers and interpreters alike have found that the most effective means of getting a message across is to relate to the public on an emotional or sensual level. While the producers seek to stimulate consumer desire, our ulterior motives are appreciation, understanding, and conservation of the environment.

Children usually make good use of their five physical senses in exploring their new world. As adults, we develop an uninvolved approach, relying primarily on vision to the gradual atrophy of our other senses. It is well known that the four 'minor' senses are more acute in a blind person, not because these persons are gifted, but because they have a learned sensitivity. The blind walk has been initiated as a means of developing our own awareness of smell, taste, hearing, and touch. Many practical applications of this sensory approach have been described by Van Matre (1972). I offer here a few of my own techniques in the hope that they can be used or adapted for use by individuals or group leaders.

## Exercise 1

Ask the group to close their eyes and sit quietly for one or two minutes, listening. Then have them draw on paper, without talking, an abstract representation of what they heard during the time period. No value is placed on artistic merit and the method should be entirely individual. To reinforce this idea, the only restriction that needs to be placed is that actual pictoral representation of sound-creating objects is not allowed.

Adults often have difficulty making this unusual association, but children and adults alike can give beautiful interpretation of their separate realities.

Exercise 2

The soles of our feet are one of the most sensitive surfaces of our bodies, yet we cover them up in preference to experiencing the world at our feet. Ask the group to take off their shoes and socks at the beginning of a blind walk. Ask them to recall for a moment mud between their toes or hopping over a gravel parking lot. This will focus attention on the feet. Then lead them blindfolded over a variety of textured surfaces -- a lawn or mossy forest floor, a mud puddle, tilled earth or sandy area, a sidewalk or warm asphalt road are all good. Ask whether they can perceive the change in temperature between sunlit and shaded areas, or detect moist and dry surfaces.

Exercise 3 (For a windy day in the open)

Ask the group to spread their arms and orient to the direction of the wind. Ask questions such as these to enhance the experience: By what senses do you perceive this air? Is it hot or cool, dry or moist, fresh or odorous? It is formless, colorless, tasteless, and odourless itself. You cannot touch it, yet it brushes your face, moves your hair. Pause to appreciate it for a moment and consider how it is life-giving. This is an especially good time to try to identify scents on the wind.

Exercise 4 (For a windy day in the forest)

Ask the group to pause and listen to the sound of the wind. Can any birds be heard? Guide individuals to separate tree trunks and ask them to listen with their ear to the bark. What sounds can they hear? Ask if they can feel the trunk sway to the symphony of sound.

The results of this experience can be variable depending on the density of the forest, the species and height of the tree, and the strength of the wind.

Exercise 5

Lead the blind person(s) to a variety of man-made or natural objects to give as rich a sensory experience of texture as possible. Suggestions: coniferous needles (Spruce is Square, Fir is Flat), rotting wood, soil, someone's hand, another person's hair (or face), a brick wall, a piece of silk, or an animal's fur.

Exercise 6

Give the group as rich an olfactory experience as possible. Some scent suggestions include fir-bark blisters, a fresh-cut lawn, crushed yarrow (Achillea), wild mint leaves (Mentha), red cedar wood (Thuja), and garlic. This exercise is especially good after a rain, when scents become fresh.

The guide's job is to provide the "blind" person with a directed experience. This is most effectively done in groups of from six to eight. With one or two people, the guide can hold his or her arm as if grasping a glass of water, and the blind person rests his arm on the guide's with his fingertips touching the guide's palm. This is a flexible way of holding hands, yet the guide can easily be a support if the other stumbles. This method is never good for guiding more than two people at a time as it is necessary for the blind person to have one hand free. Larger groups are easily led by holding onto a knotted rope at one meter spacings.

This experience involves placing considerable trust in the guide and assurance must be given to participants beforehand that obstacles will not be placed in their path and that they will be protected from anything dangerous, frightening, or embarrassing. Silence is necessary except for the directions and leading questions of the guide. Other talking only interferes with concentration on the senses. Feelings and comparisons are best shared at the conclusion of the walk.

Depending on the receptivity of the group, the blind walk should usually last 30 - 45 minutes. As the interpreter develops skill in this technique, he or she will find various exercises best suited to different groups, and will come up with new ideas tailored to his or her region.

> "Our swaddled and weary senses restrain us in a mysterious land of suspension and removal which has the qualities of distance and separation. We let nothing really touch us and become slaves to automatic living, paying very little notice to what goes on around us. Thus, we deny ourselves the fullness of living in the now, which requires that we must be able to open fully our senses and to direct our awareness."
>
> Herbert A. Otto


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# FACTS FOR ENVIRONMENTAL STUDIES

Ontario Ministry of the Environment

## ORGANIZING THE MIDDLE JUNIOR HIGH LABORATORY CLASSROOM

### Preparing for a Lab

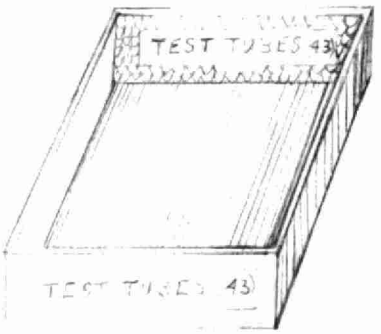
If most of your equipment is stored on open shelves and students are familiar with the locations, you may be able to run labs without a lot of special setting up. However, you can also put things out in a central supply area for the particular lab exercise being done. In setting up a central supply table, keep in mind the following guidelines:

1. List all the materials that will be needed for the lab.

2. Gather trays, tote drawers, or shallow boxes for each type of equipment needed (cafeteria trays and shoe boxes are appropriate).

3. Label each tray or box with the name of the equipment that is to be kept in it.

4. Count out the pieces of equipment needed. Write the number of articles in the tray on the tray label. If you are simply pulling a prelabeled tray from the shelf, you can count out just the pieces needed and store the spares somewhere else or simply use the whole tray. It is better to have an accurate count of materials that easily disappear than to put out a whole trayful. Check your materials after the experiment before the class leaves the room.




### Lab Teams

Assign numbers to the lab teams either permanently or for each lab depending on how often you intend to switch partners. Use these numbers to assign special tasks or equipment. This way you can make assignments with a master list of only 10 or 20 numbers rather than trying to keep track of 150 or 200 separate student assignments.

Assign a special task to each team according to team number. Much of this can be special jobs to help speed cleanup. Post a list of team assignments conspicuously in the room so that you and the students can refer to it quickly at any time.

1. Check and refill alcohol burners.

2. Sink clean-up.

3. Demonstration or supply table clean-up.

4. Check floors for paper and stray equipment.

5. Check equipment shelves for proper return of all trays.

6. Collect and store unfinished projects for the next session. (Check to see that each piece is clearly labeled.)

7. Check and refill solution and chemical bottles.

8. Count equipment that has been set out in special numbers.

Other assigned tasks can be custodianship for special or easily misplaced equipment such as safety glasses; balances and weight sets for balances; books (texts, lab manuals, instruction sheets, and lab reports); dissecting kits; and microscopes. This equipment should be numbered and the numbers should appear both on the equipment and on the shelf space or hook where it is to be stored.

If there are full class sets of the equipment, students should be instructed to use only the piece that corresponds to their team number. If each team uses more than one piece of the same equipment (e.g., safety glasses), then number with the team number followed by A,B,C, etc.,

When there are only a few pieces of the equipment (not enough to assign one to each team), set up a signout system and make one team responsible for the item. Number or letter the equipment, and provide signout sheets. The team in charge of the equipment is responsible for signing it out and giving a final accounting at the end of the period.

Safety Procedures

1. Keep the rules short and simple. This makes them easy for students to remember and easier for the teacher to enforce.

2. Teachers and guests should follow the safety rules just as carefully as the students. Junior high and middle school students tend to learn safety more by imitation and repetition than by logic. Therefore, it is extremely important that the teacher gets into the habit of following safety rules consistently, even when students are not around.

3. Label everything clearly. Reserve red for safety cautions.

4. Check the properties of unfamiliar reagents in a good reference.

   Teach your students how to use standard reference manuals as well and get them in the habit of using them.

5. Give a general lab safety lesson as early as possible. Point out locations of exits and safety equipment (fire extinguishers, showers, fume hoods, etc.) and give instruction on emergency procedure.

6. Special safety rules such as instruction on the handling of acids are much more effective when taught just prior to use. Review pertinent general rules and special safety instruction immediately before each lab involving hazards.

7. Have the students write their own copies of the safety rules and insist that these be brought to all lab classes. When special techniques are taught, the accompanying safety rules should be added to the original list.

8. Establish a signal to get immediate attention from the whole class. Use a whistle, bell, buzzer, or flick the lights. Make it clear that the signal means all activity is to come to an immediate stop.

9. Enforce the safety rules strictly and consistently. Contact parents directly and immediately in cases of habitual or deliberate disregard for safety regulations.

In the Lab

Some general points to keep in mind while working with students in the lab include the following:

1. Keep moving. Don't spend all or most of your time with one or two groups. If you haven't changed areas in five minutes, you are probably so wrapped up in the team with which you are working that you don't know what the rest of the class is really doing.

2. Keep listening. Even when working individually with students or teams, listen to what is going on elsewhere at the same time.

3. Make use of mirrors, windows, and other reflecting surfaces to check behind and around you while working where your direct view is obstructed. No matter where you are in the room, keep eyes and ears open for signals from everywhere else.

4. Encourage students to help each other. Instead of answering each question several times, refer students to other students whom you helped with the same problem.

5. Respond to quiet calls for help before noisy tantrums.

6. Encourage use of reference materials for factual information.

7. Establish a signal to get immediate full class attention.

8. STAY CALM!

Handbooks

Some good standard references for the laboratory classroom are:

Handbook of Chemistry and Physics, Robert C. Weast, ed., The Chemical Rubber Co. Press, Cleveland Ohio (yearly).

The Merck Index, Paul G. Stecher, ed., Merck & Co., Inc., Rahway, N.J. 1976 (9th edition).

Handbook of Nature Study, Anna Botsford Comstock, Comstock Publishing Co., Inc., Ithaca, N.Y. 1939.

Wanted: Safety, Jacob Brodkin, Nassau County Science Supervisor's Association, c/o Bernard McFadden, 3798 Reagent Lane, Wantagh, N.Y. ($1).

Laboratory Waste Disposal Manual. Manufacturing Chemists Association, Washington, D.C. 1969 (rev. 1973).

## Breakage

In a working lab, it is inevitable that things will break. This usually occurs with an audible crash followed by dead silence or possibly a cheer as the class waits to observe the teacher's reaction. Regardless of the reason for the accident, a good immediate response is to quietly give instructions to clean up quickly without further disruption. This gives the teacher time to determine the cause of the breakage and decide what to do about it.

Different schools have their own rules about breakage fees, so it is best to check the general procedure first. One method that has worked well is to charge the student the current cost of the item if it is broken because of carelessness and double the cost if it is broken on purpose or while doing something specifically restricted.

In any case, keep a record of all the items that are broken along with date and name of the student who broke it. You may find some consistent patterns and want to take some time to check on the technique of students habitually breaking things or change a procedure if a lot of children keep having similar accidents.

## Cleanup

Cleanup can make or break a laboratory program. It is imperative that the room be cleaned up and put back in order at the end of each period, not just once at the end of the day or when you can no longer stand the mess. Classes entering a messy lab tend to work more sloppily and leave the lab in worse shape at the end of the period. A number of factors contribute to efficient and relatively stress-free cleanup periods:

1. Insist on proper cleanup from the very first lab. Don't wait until the sloppiness obstructs progress. Continue to check cleanup in every lab period, not just intermittently.

2. Make each person responsible for his or her own area and materials but don't hesitate to ask students to help each other as well. Likewise help them and ask that they help you.

3. Assign individuals or teams to take charge of common areas and to check on the return of various items.

4. Scan common areas such as sinks and supply tables several times during the period. If things are unsatisfactory, stop the whole class right then and have the mess cleaned up before allowing anyone to continue regular work.

5. Store glassware on drying racks or open shelves. Let the natural process of evaporation take care of drying. This saves time and paper towels.

6. Plan for cleanup time in the regular lesson schedule. Don't just squeeze it in between the dismissal bell and the next class. Initially, this may take 10 or 15 minutes, but time can be shortened to less than five minutes in a lab where materials are clean and easily located. Give a warning one to five minutes before cleanup time so students can wind up their experiments or get them set to store overnight. When cleanup time arrives, stop all lab work and get everyone to straighten things up and put things away.

7. Use plenty of labeling. Label shelves and materials, trays, and bottles, so students can tell where to put things even after forgetting where they got them.

8. Have everyone return to seats after cleanup. Then take a minute to scan common areas, desks, lab benches, sinks, and equipment. Don't dismiss anyone until all is in order.

9. Don't forget the compliments. If things look good or cleanup was quick and efficient, reward the students by letting them know you noticed.

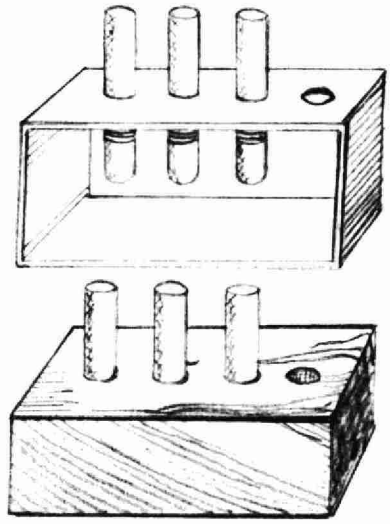
## Waste Disposal

For ecological as well as economic reasons, consideration should be given to waste disposal and the possibilities of recylcing. Solid wastes are usually the most troublesome, particularly if they are also wet and only partially congealed. If the material is relatively dense, a pail or deep container in the sink works well. Students can be instructed to dump and rinse directly into the pail where the solids can be collected and prevented from stopping the drain.

Thought should also be given to the possible reuse of materials. In some of the new science programs, many of the solutions can be reused, even after they have been diluted or slightly contaminated. Remember to keep separate containers for fresh stock and contaminanted stock. Sometimes the end products of one experiment are used as reactants for another experiment.

Provide separate waste containers for broken glass, used matches, and organic wastes. As with everything else, mark waste disposal containers clearly and place them where students are most likely to dump materials, near the sink or supply tables.

## Improvising Equipment



Improvising equipment can be both challenging and satisfying. It is a concrete way to boost ecology and demonstrates that good science does not require stainless steel laboratories with rows of flawless test tubes. Improvisation may trim quite a bit from a tight science budget and be a lifesaver if you just can't find what you need. For example test tube racks may be improvised by cutting holes in shoe boxes or milk cartons or by drilling holes in a piece of wood.

Students are quite good at improvising equipment. Often they are able to construct simple devices that perform the same functions as more expensive pieces of specialized equipment simply because they see the problem first and not the classical apparatus. Good sources of ideas, help, and material are other science teachers, custodians, the cafeteria staff, and shop teachers. Some of their clutter may be just what you need.

Good luck with your next lab. Try to relax and enjoy it!

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